Sparse (or not) Aperture IR Imaging with LSAT

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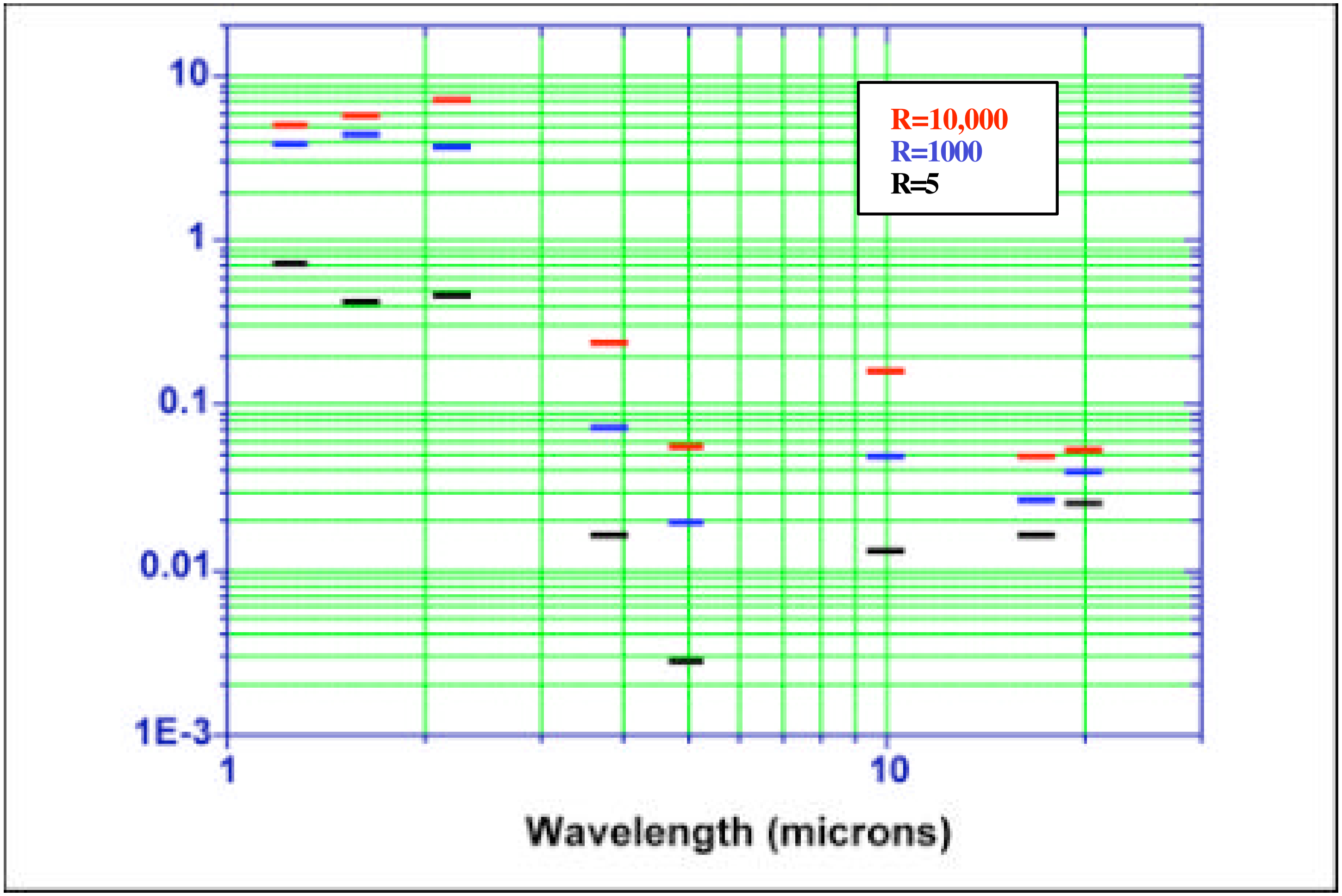
Suppose:

We have a 25 m telescope with 10 μm RMS surface

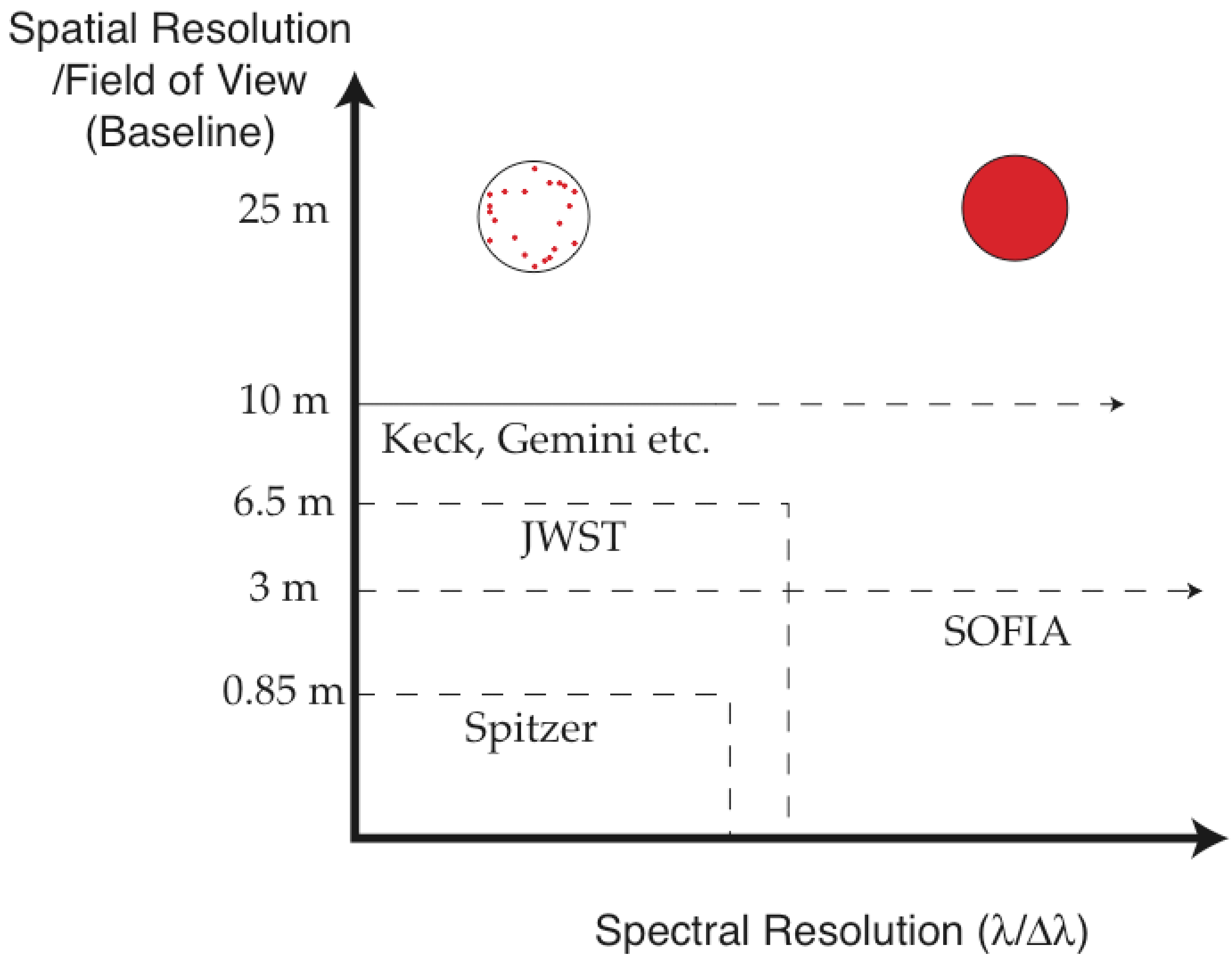
What can we do in the Infrared (λ=10-40μm)?

Ground vs Space

S/N
GSMT/
JWST



Infrared Niches



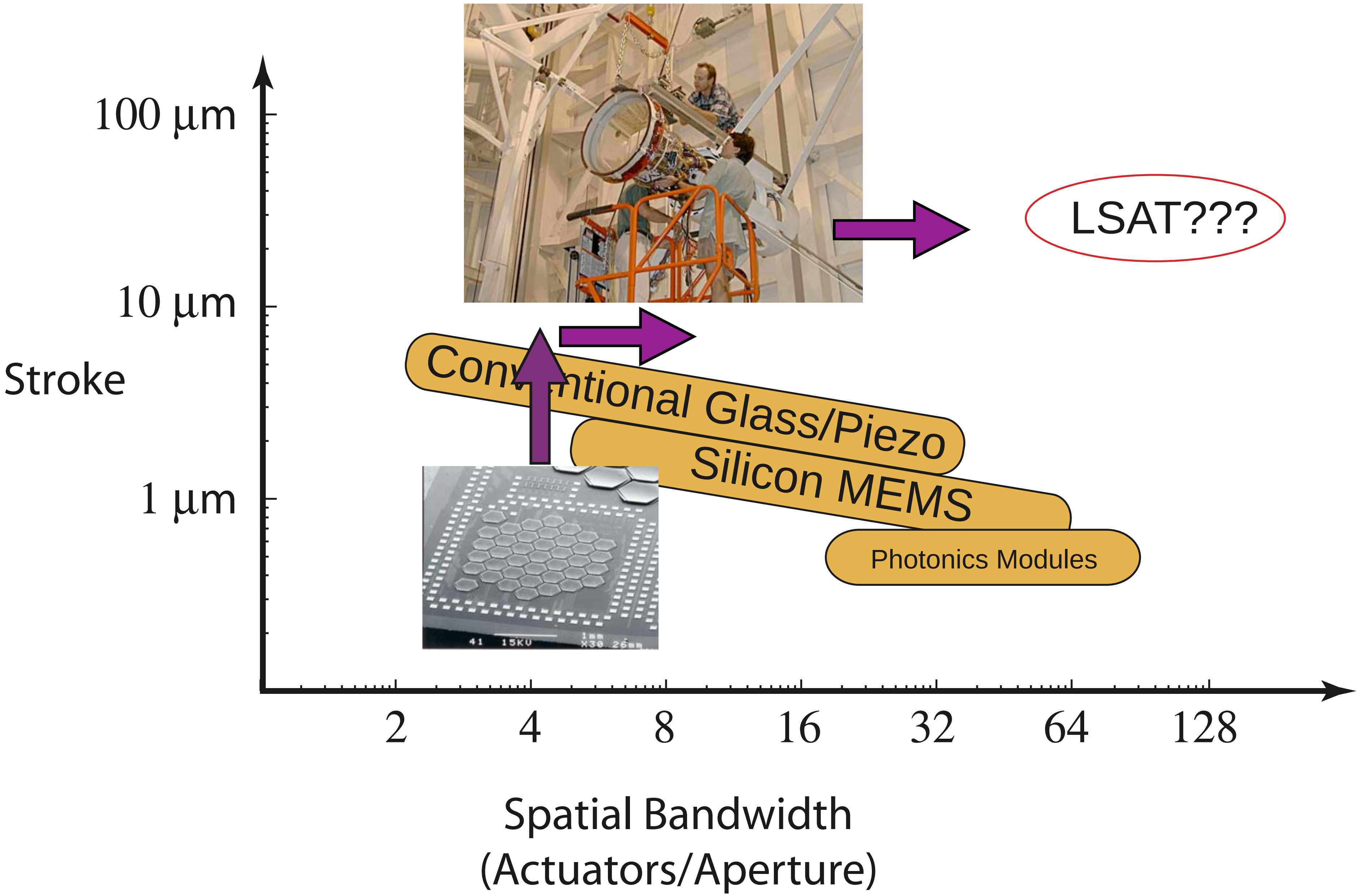
A Light Bucket?

$$\mathrm{SNR} \propto \frac{F_\nu A_{\mathrm{Tel}}}{\sqrt{A_{\mathrm{Tel}}\Omega_{\mathrm{Tel}} I_\nu}}$$

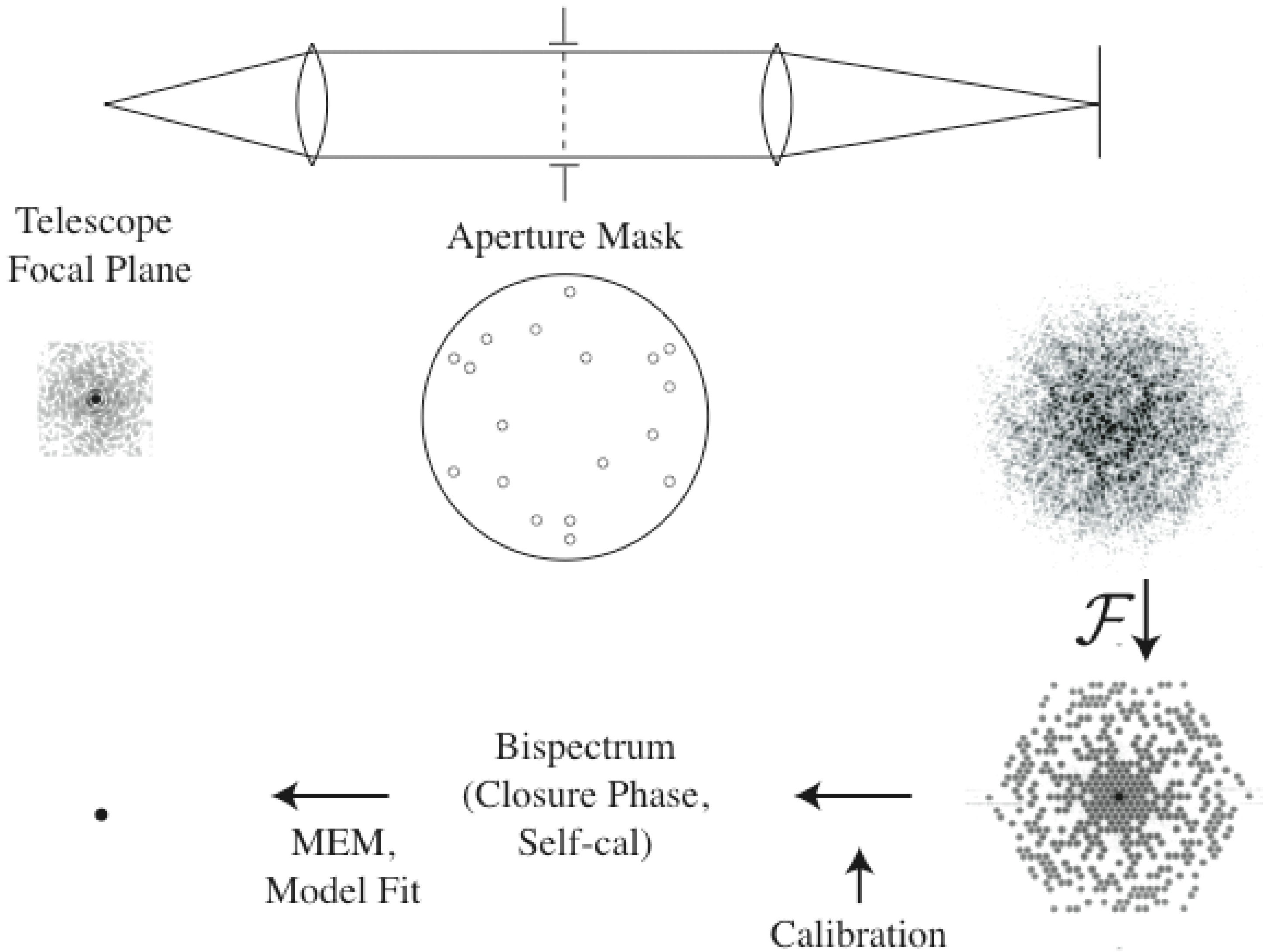
$$\propto \frac{D^2}{\sqrt{D^2 \Delta\theta^2}}$$

$$\propto \frac{D}{\Delta\theta}$$

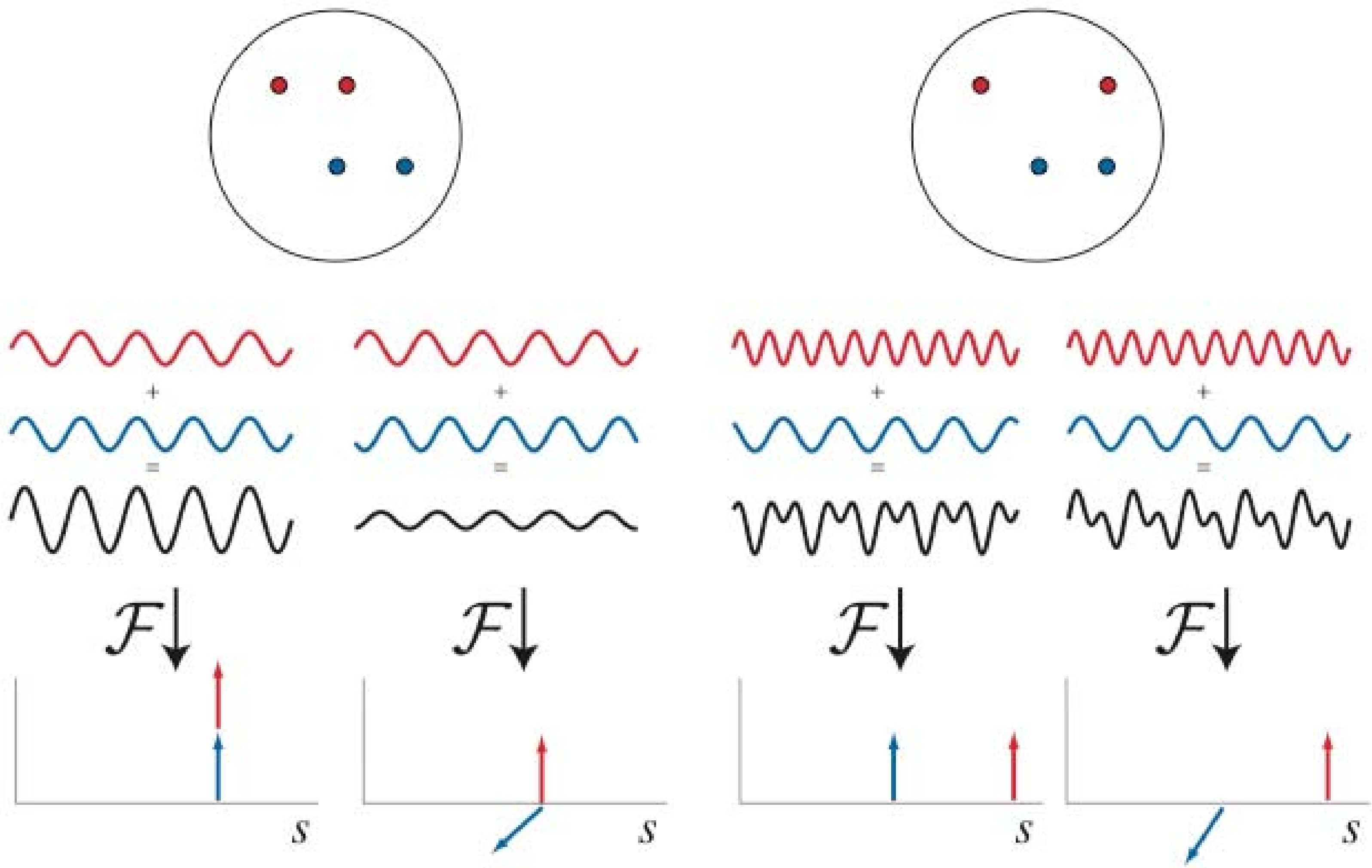
What about Adaptive Optics?



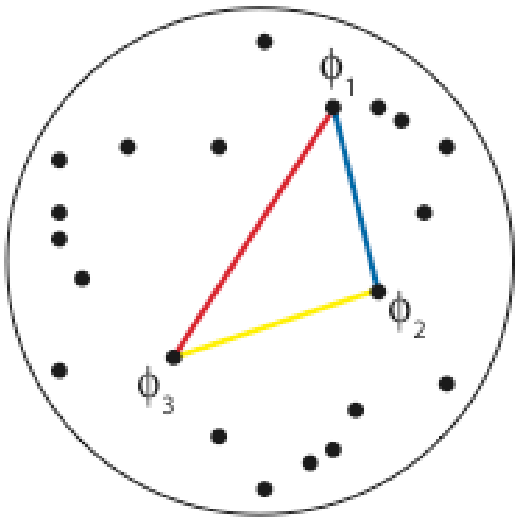
Aperture Masking

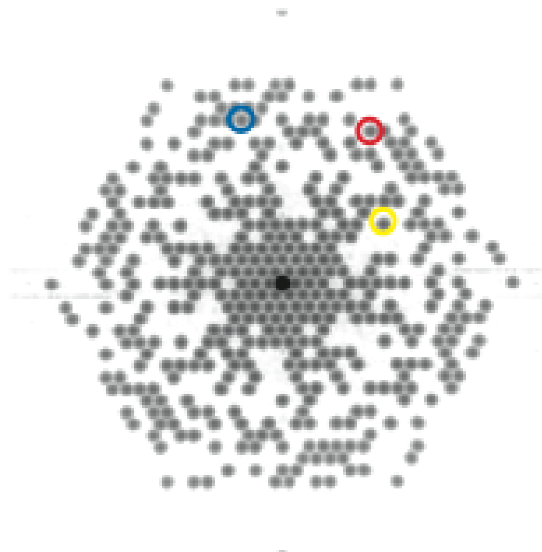


Redundancy



Closure Phase/Bispectrum





$\phi_2 - \phi_1$

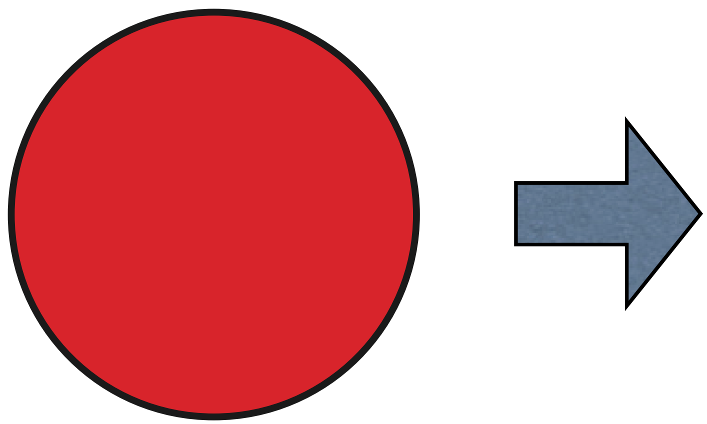
$\phi_1 - \phi_3$

$\phi_3 - \phi_2$

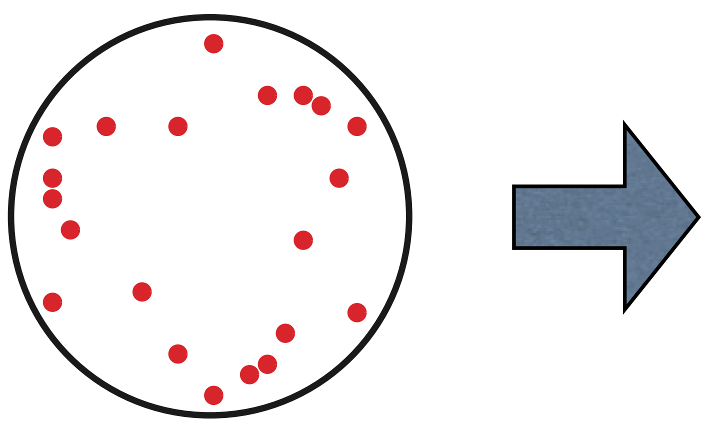
$$\phi_2 - \phi_1 + \phi_1 - \phi_3 + \phi_3 - \phi_2 = 0$$

$$\beta_{klm} = e^{i\Phi_k} e^{i\Phi_l} e^{i\Phi_m} = e^{i(\Phi_k + \Phi_l + \Phi_m)}$$

Co-Phasing

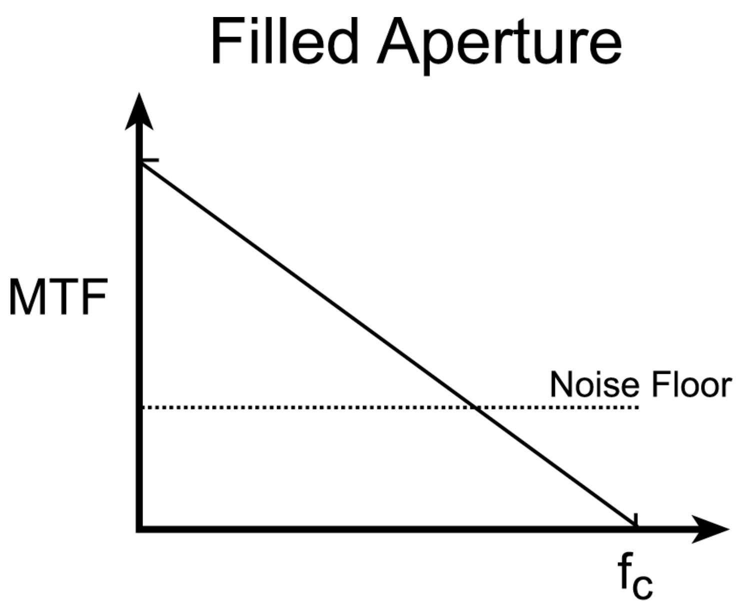


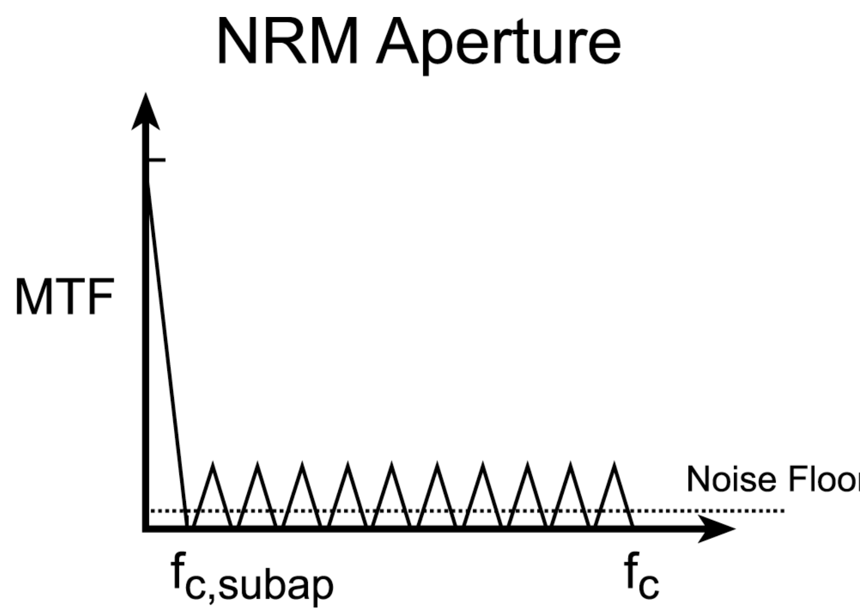
$$\frac{\lambda}{N}$$



$$\frac{\lambda^2/\Delta\lambda}{N}$$

But, all those precious photons!!!





Conclusions

- Filled Aperture IR sounds really hard
- Sparse Aperture sounds possible
- Recovery of phases can be used for telescope phasing (low order)